What is claimed is:

1. A fluorination treatment apparatus comprising a fluorine gas storage/feed vessel for storing and feeding a fluorine gas, a reactor for bringing a substance to be treated into contact with a fluorine gas to carry out fluorination reaction, and a fluorine gas pipe arranged between the fluorine gas storage/feed vessel and the reactor, wherein at least a portion to be brought into contact with the fluorine gas is constituted of a material having a chromium concentration of not more than 1% and/or a titanium concentration of not more than 1%.

2. The fluorination treatment apparatus as claimed in claim 1, wherein the material of at least a portion to be brought into contact with the fluorine gas is at least one of nickel, a nickel alloy, copper, a copper alloy, aluminum and an aluminum alloy.

3. A process for producing a fluorination treated substance, comprising:

an enclosure step of enclosing a substance to be treated in a reactor, and

a fluorination reaction step of introducing a fluorine type gas into the reactor to bring the substance

to be treated into contact with the fluorine type gas and thereby carry out fluorination reaction.

4. A process for producing a fluorination treated substance, comprising:

an enclosure step of enclosing a substance to be treated in a reactor,

a fluorination reaction step of carrying out fluorination reaction of the substance to be treated which has been enclosed in the reactor, and

a heat treatment step of heating the substance to be treated which has been enclosed in the reactor, to the prescribed temperature.

5. A process for producing a fluorination treated substance, comprising:

an enclosure step of enclosing a substance to be treated in a reactor,

a water content exhaust step of exhausting water content from the reactor,

a fluorination reaction step of carrying out fluorination reaction of the substance to be treated which has been enclosed in the reactor,

a cooling step of cooling the substance to be treated which has been enclosed in the reactor, and

a withdrawal step of withdrawing the treated substance from the reactor,

wherein the treating temperature in the water content exhaust step is in the range of 100 to 170°C, and

the temperature in the reactor in the fluorination reaction step is in the range of 10 to 150°C, and the fluorine concentration in the reactor in this step is in the range of 1000 ppm to 100%.

6. A process for producing a fluorination treated substance, comprising:

an enclosure step of enclosing a substance to be treated in a reactor,

a water content exhaust step of exhausting water content from the reactor,

a fluorination reaction step of carrying out fluorination reaction of the substance to be treated which has been enclosed in the reactor,

a heat treatment step of heating the substance to be treated which has been enclosed in the reactor, to the prescribed temperature,

a cooling step of cooling the substance to be treated which has been enclosed in the reactor, and

a withdrawal step of withdrawing the treated substance from the reactor,

wherein the temperature in the reactor in the fluorination reaction step is in the range of 10 to 150°C, and the fluorine concentration in the reactor in this step is in the range of 1000 ppm to 100%, and

the temperature in the reactor in the heat treatment step is higher than the temperature in the reactor in the fluorination reaction step, and the fluorine concentration in the reactor in the heat treatment step is lower than the fluorine concentration in the reactor in the fluorination reaction step.

7. The process for producing a fluorination treated substance as claimed in claim 3, wherein the fluorination reaction step has:

a pressure control step of controlling the total pressure and the fluorine partial pressure in the reactor to the prescribed pressures, and

a temperature control step of controlling the temperature in the reactor to the prescribed temperature.

8. The process for producing a fluorination treated substance as claimed in claim 3, wherein the total pressure in the reactor in the fluorination reaction step is in the range of 0.01 to 1.0 MPa.

9. The process for producing a fluorination treated substance as claimed in claim 3, wherein the fluorination treatment apparatus of claim 1 is employed.

10. The process for producing a fluorination treated substance as claimed in claim 3, wherein the substance to be treated is any one of a fluoride thin film, a fluoride powder, a fluoride solid and a fluoride optical element.

11. The process for producing a fluorination treated substance as claimed in claim 10, wherein the substance to be treated is a fluoride optical element obtained by abrading a surface of a fluoride solid with abrasive grain.

12. The process for producing a fluorination treated substance as claimed in claim 11, wherein the fluorination reaction step is a step of cleaning the

fluoride optical element that is the substance to be treated.

13. The process for producing a fluorination treated substance as claimed in claim 11, wherein the abrasive grain is at least one material selected from the group consisting of silicon dioxide, silicon carbide, boron carbide, cubic boron nitride and diamond.

14. The process for producing a fluorination treated substance as claimed in claim 13, wherein the abrasive grain is silicon dioxide.

15. The process for producing a fluorination treated substance as claimed in claim 11, wherein the temperature in the reactor in the fluorination reaction step is in the range of 10 to 500°C.

16. The process for producing a fluorination treated substance as claimed in claim 10, wherein the fluoride optical element is a fluoride optical element having a fluoride optical thin film laminated thereon.

17. The process for producing a fluorination treated substance as claimed in claim 16, wherein the fluorination reaction step is a step of heating the fluoride optical thin film to densify the film.

18. The process for producing a fluorination treated substance as claimed in claim 16, wherein the temperature in the reactor in the fluorination reaction step is in the range of 200 to 400°C, and the fluorine gas concentration in the reactor in this step is in the range of 10 ppm to 100%.

19. The process for producing a fluorination treated substance as claimed in claim 10, wherein the fluoride thin film, the fluoride powder, the fluoride solid and the fluoride optical element are each constituted of at least one material selected from the group consisting of magnesium fluoride, calcium fluoride, lithium fluoride, lanthanum fluoride, aluminum fluoride, neodymium fluoride, gadolinium fluoride, yttrium fluoride, dysprosium fluoride, barium fluoride, sodium fluoride, bismuth fluoride, strontium fluoride, lead fluoride, selenium fluoride, cryolite and chiolite.

20. The process for producing a fluorination treated substance as claimed in claim 3, wherein the fluorine type gas is at least one gas selected from the group consisting of a pure fluorine gas; a fluorine gas diluted with at least one rare gas of helium, neon, argon, krypton and xenon; a gas containing fluorine atoms released during the treatment from the inner surface of the reactor having been previously fluorinated; a gas containing fluorine atoms released during the treatment from a previously fluorinated metal, a fluorine-excess alloy or a fluorine-excess fluoride placed in the reactor; a fluorine gas generated by electrolysis of a metallic fluoride; a gas obtained by sublimating or evaporating a fluorine-rare gas compound of XeF_2, XeF_4 or XeF_6 and a fluorine gas generated by decomposition of the fluorine-rare gas compounds; and a gas containing active fluorine of fluorine radical or fluorine ion generated by dissociating at least one of a carbon-fluorine compound, a sulfur-fluorine compound and a nitrogen-fluorine compound.

21. The process for producing a fluorination treated substance as claimed in claim 3, wherein the fluorine type gas contains a fluorine gas.

22. The process for producing a fluorination treated substance as claimed in claim 3, wherein the fluorine type gas is a gas containing fluorine generated by dissociating a fluorine-containing compound containing at least one material selected from the group consisting of carbon fluoride, sulfur fluoride, nitrogen fluoride, metallic fluoride, hydrogen fluoride, halogen fluoride and fluoride of a rare gas, by means of heat, electricity or plasma, or a fluorine gas.

23. A fluorination treated substance obtained by the process of claim 3.

24. The fluorination treated substance as claimed in claim 23, which is a fluoride optical element.

25. A fluorination treated substance being a fluoride optical element obtained by the process of claim 12, wherein the difference in the light absorption loss of the surface at 157 nm between before and after the fluorination treatment is not less than 0.1%.

26. A fluorination treated substance obtained by the process of claim 16, which is a fluoride optical element having a fluoride optical thin film whose pores capable of being invaded by water vapor, a volatile organic matter and a volatile inorganic matter are closed.